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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 355)

AUGUST 22, 1997

01
AERONAUTICS

19970022966 Logistics Management Inst., McLean, VA USA
The ASAC Flight Segment and Network Cost Models ***Final Report***
Kaplan, Bruce J., Logistics Management Inst., USA; Lee, David A., Logistics Management Inst., USA; Retina, Nusrat, Logistics Management Inst., USA; Wingrove, Earl R., III, Logistics Management Inst., USA; Malone, Brett, Phoenix Integration, USA; Hall, Stephen G., Phoenix Integration, USA; Houser, Scott A., Phoenix Integration, USA; Apr. 1997; 204p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01
Report No.(s): NASA-CR-201679; NAS 1.26:201679; LMI-NS602T2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

To assist NASA in identifying research art, with the greatest potential for improving the air transportation system, two models were developed as part of its Aviation System Analysis Capability (ASAC). The ASAC Flight Segment Cost Model (FSCM) is used to predict aircraft trajectories, resource consumption, and variable operating costs for one or more flight segments. The Network Cost Model can either summarize the costs for a network of flight segments processed by the FSCM or can be used to independently estimate the variable operating costs of flying a fleet of equipment given the number of departures and average flight stage lengths.
Author
Network Analysis; Cost Analysis; Trajectories; Economic Analysis; Air Transportation

19970023093 Deutsche Aerospace A.G., Surface Treatment, Munich, Germany
Experiences in Maintenance and Overhaul of Military Aircraft
Unterreiner, Heinz, Deutsche Aerospace A.G., Germany; Stein, Ruth, Mankiewicz Gebr. and Co., Germany; Feb. 1997; 26p; In English; Also announced as 19970023078; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Corrosion as an unavoidable fact requires cost effective control measures. by these control measures, aircraft life will be much longer in comparison with the precautions taken during the manufacturing of a/c. The main philosophy gained by the experiences of maintaining more than 5000 a/c is determined by detection and removal of corrosion, followed by renewal of the protective coating in the very early stages of corrosion. It has to be repeated in determined intervals, based on the lessons learned over the years. A steady development of new coating systems is associated with the elimination of toxic/hazardous chemicals and slower aging of the organics. With respect to human and environment protection, protective coatings, the problems of how to get the higher chemical and mechanical resistant coatings removed, and the goal of collecting all divergent properties under cost effective measures are the guidelines in the aircraft maintenance area.
Author
Aircraft Maintenance; Environment Protection; Protective Coatings; Coating

19970023380 Defence Science and Technology Organisation, Melbourne, Australia
Finite element analysis of an F-111 lower wing skin fatigue crack repair
Callinan, R. J., Defence Science and Technology Organisation, Australia; Sanderson, S., Defence Science and Technology Organisation, Australia; Keeley, D., Defence Science and Technology Organisation, Australia; Jan. 1997; 58p; In English
Report No.(s): DSTO-TN-0067; AR-009-961; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia, Hardcopy, Microfiche

In this report a three dimensional finite element (F.E.) model has been developed for a structural detail in an F-111 lower wing skin. The location of interest is a fuel-flow groove in the lower wing skin where cracking had occurred in service on aircraft

A8-145. Detailed models were developed for (i) un-cracked structure; (ii) the cracked structure and (iii) the repaired structure, using a bonded composite patch for the repair. The objective of this work is to validate the design analysis used by the RAAF, using an independent approach for the stress analysis. The F.E. model has been validated using strain gauge results from a full scale test wing. The results of the F.E. analysis are shown to compare favorably with closed form solutions used by the RAAF (RAAF Engineering Standard C5033) in the original design of the repair. Thus the present work provides a basis for confidence in the design procedures contained in RAAF Engineering Standard C5033.
Author
Finite Element Method; Design Analysis; F-111 Aircraft; Wings; Stress Analysis; Fatigue (Materials)

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970022478 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA
Some Structural Features of a Turbulent Wing-Body Junction Vortical Flow, *1 Jan. - 30 Sep. 1996*
Olcmen, M. Smith, Virginia Polytechnic Inst. and State Univ., USA; Simpson, R. L., Virginia Polytechnic Inst. and State Univ., USA; Sep. 30, 1996; 111p; In English
Contract(s)/Grant(s): N00014-94-I-0092
Report No.(s): AD-A321557; VPI-AOE-238; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The horse-shoe vortex that forms around a wing-wall junction is experimentally investigated. Laser-Doppler velocimeter measurements of mean velocity and higher order statistics including the third order products are reported for 15 measurement stations in one plane to the side of the junction of a 3:2 elliptical nose, NACA 0020 tail wing and a wall. The approach Reynolds number of the air flow based on momentum thickness is approximately 5940. The outer layer vortical structure on the down-wash or wing side results in a thin boundary layer and lower turbulence intensity due to the redirected free-stream. Lateral pressure-gradients cause separation on the uplifting side of the vortex on the wall. Bimodal histograms of the w fluctuating velocity occur under the vortex core near the wall. A vortical structure with higher vorticity concentration and opposite sense to the large vortical structure is located below the large vortical structure. High normal stress values are obtained at the wing-wall junction. In this wing-wall junction region a vortical structure of the same rotation sense of the large outer layer vortex forms. Triple products describe the diffusion processes for this type of a flow. In such a flow the shear-stress angle (SSA) highly lags the flow-gradient angle (FGA) and the turbulent structure highly lags the mean flow. The turbulence diffusion is highly altered due to the presence of the large outer layer vortical structure.
DTIC
Body-Wing Configurations; Air Flow; Turbulent Flow; Laser Doppler Velocimeters; Shear Stress; Turbulent Boundary Layer; Vortices; Lift; Three Dimensional Flow; Turbulent Diffusion

19970022898 NASA Langley Research Center, Hampton, VA USA
Transition and Turbulence Modeling for Blunt-Body Wake Flows
Nance, Robert P., North Carolina State Univ., USA; Horvath, Thomas J., NASA Langley Research Center, USA; Hassan, H. A., North Carolina State Univ., USA; Jun. 25, 1997; 6p; In English; 32nd; Thermophysics, 23-25 Jun. 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC1-112
Report No.(s): NASA-CR-203997; NAS 1.26:203997; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Aerobraking has been proposed as an efficient means of decelerating spacecraft for planetary missions. Most current aerobrake designs feature a blunt forebody shielding the payload from the intense heat generated during atmospheric entry. Although this forebody will absorb the largest portion of the heat pulse, accurate prediction of heating in the near wake is of great importance, since large local heating values can occur at points of shear-layer impingement. In order to address the various issues associated with these blunt-body wake flowfields, the Advisory Group for Aerospace Research and Development (AGARD) formed Working Group 18 in 1992. One of the objectives of this activity was to examine real-gas effects in high-speed flow fields around a 70 deg. blunted cone. to date, many researchers have conducted experiments using this geometry in various facilities, such as the Large Energy National Shock (LENS) tunnel at Cubric/Calspan and the HEG shock tunnel at DLR-Goettingen. Several computational studies have also been conducted in concert with these tests. Many of the experimental results have indicated the possible presence of a transitional shear layer through a large increase in heat transfer downstream of the reattachment point. The presence of transition could in fact lead to much higher peak heating than if the separated flow is entirely laminar or turbulent. In the shock-

tunnel tests, however, it is difficult to separate such viscous-flow phenomena from real-gas effects. In order to help make this distinction, Horvath et al. recently conducted a set of experiments in the NASA Langley 20-Inch Mach 6 Tunnel, and compared the results to laminar Navier-Stokes calculations. They found heat-transfer distributions similar to those obtained in the high-enthalpy facilities, with the measured peak heating along the sting support markedly greater than that predicted by the laminar computations. These trends point to the need to find transitional and turbulent computational solutions for these flowfields.
Author
Turbulence Models; Blunt Bodies; Wakes; Flow Distribution; Aerobraking

19970022981 NASA Langley Research Center, Hampton, VA USA
CFL3D: Its History and Some Recent Applications
Rumsey, C. L., NASA Langley Research Center, USA; Biedron, R. T., NASA Langley Research Center, USA; Thomas, J. L., NASA Langley Research Center, USA; May 1997; 10p; In English; Gudunov's Method for Gas Dynamics: Current Applications and Future Developments, 1-2 May, 1997, Ann Arbor, MI, USA
Contract(s)/Grant(s): RTOP 522-31-21-01
Report No.(s): NASA-TM-112861; NAS 1.15:112861; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The history of the Computational Fluids Laboratory -3D (CFL3D) Navier-Stokes computer code is discussed and a comprehensive reference list is given. Three recent advanced applications are presented (1) Wing with partial-spanflap, (2) F/A-18 with forebody control strake, and (3) Noise predictions for an advanced ducted propeller turbomachinery flow.
Author
Navier-Stokes Equation; Turbomachinery; Computational Fluid Dynamics; Aerodynamics; Applications Programs (Computers); F-18 Aircraft

19970023140 National Aerospace Lab., Amsterdam, Netherlands
An Explicit Multi Time Stepping Algorithm for Aerodynamic Flows
Ven, H. vander, National Aerospace Lab., Netherlands; Niemann-Tuitman, B. E., National Aerospace Lab., Netherlands; Veldman, A. E. P., National Aerospace Lab., Netherlands; Jul. 08, 1996; 15p; In English; International Congress on Computational and Applied Mathematics, 21-26 Jul. 1996, Leuven, Belgium
Report No.(s): AD-A321792; NLR-TP-96431-U; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
An explicit multi time stepping algorithm with applications to aerodynamic flows is presented. In the algorithm in different parts of the computational domain different time steps are taken, and the flow is synchronized at so-called synchronization levels. The algorithm is validated for aerodynamic turbulent flows. For two dimensional flows speedups in the order of five with respect to single time stepping are obtained.
DTIC
Algorithms; Turbulent Flow; Aerodynamic Characteristics

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970023036 Army Safety Center, Fort Rucker, AL USA
Army Ground-Accident Report Countermeasure, Volume 18
Feb. 1997; 12p; In English
Report No.(s): AD-A322330; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Commanders whose units experience aircraft and ground-vehicle accidents are increasingly confronted not only with the accident and the resultant loss of valuable resources but also with exposure of personnel to accident-site hazards such as advanced composite materials, or ACMs. Even though the immediate symptoms of exposure to AM hazards (headache, burning eyes, and vomiting) may not be evident, the potential still exists for long-term health problems. Therefore, it is crucial that personnel who must work near an accident site be informed of the hazards so that they can take appropriate precautions to lessen their risk of exposure. Personnel responding to aircraft and ground-vehicle accidents are most at risk because of their immediate exposure to ACMs and other accident-site hazards such as bloodborne pathogens (see sidebar on page 3). However, first responders are not

the only ones at risk. Individuals involved in the subsequent investigation, recovery, and cleanup operations also may be exposed to these accident-site hazards.
DTIC
Accident Prevention; Signs and Symptoms; Aircraft Accidents; Wound Healing; Injuries

19970023120 Army Safety Center, Fort Rucker, AL USA
Flightfax: Army Aviation Risk-Management Information, Volume 25 ***Monthly Report***
Mar. 1997; 12p; In English
Report No.(s): AD-A322519; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In Army aviation, we devote a lot of paper and a lot of ink to crashes and the error s that caused them. We do this so that other Army aviators can learn hard-bought lessons without experiencing them first hand. But there are also lessons to be learned from in flight emergencies that have a happy ending-those that could have ended in disaster but didn't because of the way the crews responded. These are lessons in crew coordination and maintaining aircraft control. They're lessons in good judgment, good execution, and performing to standard. They're lessons about crews staying calm and thinking clearly and working together and using exceptional skill to recover from the unexpected. They're the best kind of lessons; those we learn from catastrophic accidents that didn't happen.
DTIC
Aircraft Accidents; Aircraft Safety; Armed Forces

19970023376 NASA Lewis Research Center, Cleveland, OH USA
Wind Tunnel Measured Effects on a Twin-Engine Short-Haul Transport Caused by Simulated Ice Accretions: Data Report
Reehorst, Andrew, NASA Lewis Research Center, USA; Potapczuk, Mark, NASA Lewis Research Center, USA; Ratvasky, Thomas, NASA Lewis Research Center, USA; Laflin, Brenda Gile, NASA Langley Research Center, USA; May 1997; 102p; In English; CD-ROM conforms to the ISO 9660 standard
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA-TM-107419; NAS 1.15:107419; NONP-NASA-CD-1997034739; E-10659; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this report is to release the data from the NASA Langley/Lewis 14 by 22 foot wind tunnel test that examined icing effects on a 1/8 scale twin-engine short-haul jet transport model. Presented in this document are summary data from the major configurations tested. The entire test database in addition to ice shape and model measurements is available as a data supplement in CD-ROM form. Data measured and presented are: wing pressure distributions, model force and moment, and wing surface flow visualization.
Author
Flow Visualization; Jet Aircraft; Pressure Distribution; Ice Formation; Ice; Transport Aircraft

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970022254 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
Applications and Development of Global Positioning System
Ge, Ban-Jun, Aerospace Industry Headquarters, China; Wang, Cheng-Lin, Beijing Univ. of Aeronautics and Astronautics, China; Satellite Application; Oct. 15, 1996, No. 3; 21p; In English; Translated into English by Leo Kanner Associates
Contract(s)/Grant(s): F33657-88-D-2188
Report No.(s): AD-A321326; NAIC-ID(RS)T-0369-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a general description of the major applications of the Global Positioning System (GPS) in civil and military areas. Also, it proposes some countermeasures and suggestions concerning the applications of the Global Positioning System in China by analyzing the GPS receiver market and its development in the years to come.
DTIC
Global Positioning System; Navigation

19970022266 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

GPS and Its Application in Navigation System Test Flights

Proceedings of CSAA 11th Conference of Flight Mechanics and Flight Test; Oct. 1996, No. 8; 17p; In English; 11th; Flight Mechanics and Flight Test, 1994, China; Translated into English by Leo Kanner Associates

Contract(s)/Grant(s): F33657-88-D-2188

Report No.(s): AD-A321324; NAIC-ID(RS)T-0370-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the rapid development of science and technology, the global positioning system appeared in April, 1993, when the USA sent the last satellite into orbit and declared that the GPS constellation of 24 satellites was finally deployed. This system, gradually perfected and mature, has been widely applied in aviation, aerospace, sea voyage, geodesy, land navigation as well as in various military and civil projects. Featuring global coverage, all-weather operation, high cost-efficiency of user equipment and capabilities of providing high precision data, including location, velocity and time, GPS and differential GPS were successfully applied in the navigation system test flights as location and velocity references.

DTIC

Global Positioning System; Navigation

19970022416 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

Research Associated with Single Gyroscope Dual Ring Platform Inertial Guidance Systems

Liu, Shi-Duan; China Astronautics and Missilery Abstracts; Dec. 1996; Volume 3, No. 1, pp. 43-48; In English; Translated into English by SCITRAN

Contract(s)/Grant(s): F33657-84-D-0165

Report No.(s): AD-A321069; NAIC-ID(RS)T-0301-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article puts forward, and, in conjunction with that, studies mixed inertial and geomagnetic navigation systems composed of single gyroscope dual ring inertial platforms and solid state geomagnetometers. In the article, discussion is made of system construction as well as operating principle. In depth study is made with regard to system mechanical lay out. In conjunction with this, analyses are completed of system accuracy with a view toward cruise missile flight status. Combined inertial/geomagnetic navigation systems are capable of supplying navigation end guidance information which is the same as that associated with inertial guidance systems. They are not only capable of providing longitude and latitude. They are, moreover, able to supply such information as surface (illegible) as well as attitude angles, and so on. Due to the fact that inertial platforms only make use of one gyroscope and two accelerom eters and there is also no bearing stability circuitry, therefore, the structure is simple. Manufacture is easy, and volumes are small. Costs are low. Another obvious advantage associated with the systems in question is that there is no need to carry out azimuth alignment. Preparation times are very, very much shortened.

DTIC

Inertial Guidance; Inertial Navigation; Geomagnetism; Accuracy; Attitude (Inclination); Latitude

19970022505 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

Long Range Differential GPS and the Concepts of Chinese Plans to Establish Broad Area Networks

Lu, Guo-Hua; Liu, Yan-Li; Telemetry and Telecontrol; Dec. 16, 1996; Volume 2, No. 6, pp. 1-11; In English; Translated into English by SCITRAN

Contract(s)/Grant(s): F33657-84-D-0165

Report No.(s): AD-A321020; NAIC-ID(RS)T-0363-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article describes the general status of radio navigation and positioning systems. Stress is laid on introducing Global Positioning System (GPS) global navigation systems, putting forward the use of methods associated with differential GPS in order to raise positioning precisions and carry out long range differential tests from Xian to Luoyang and Jinxi. Recommendations are made to set up a Chinese differential GPS network.

DTIC

Global Positioning System; Communication Networks; Radio Navigation

19970022955 National Aerospace Lab., NAL/NASDA Hope Team, ALFLEX Group, Tokyo, Japan

System Design of the Automatic Landing Flight Experiment (ALFLEX)

Nov. 1996; ISSN 0389-4010; 86p; In Japanese

Report No.(s): NAL-TR-1313; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The National Aerospace Laboratory and the National Space Development Agency of Japan are working on in the development of an unmanned space re-entry system called HOPE which is planned for launch by an H-II rocket. At the preliminary stage of this project, research on the automatic landing using a dynamically scaled model of HOPE is currently being conducted. The

model is called ALFLEX which is an abbreviation of the Automatic Landing Flight EXperiment. The objectives of ALFLEX are to establish the fundamental technology necessary for the landing of HOPE, including the design methodology of the navigation, guidance and control system, and the evaluation method for the flight experiments using a subscale model. The 37% scaled ALFLEX vehicle is lifted by a carrier helicopter up to a height of 1,500 m and is released at a level speed of 46 m/s. Then, relying upon an integrated guidance system, it captures the specified glide slope and lands horizontally on a 1,000 m long runway after flaring to shallower glide slopes. The present paper describes the results of the ALFLEX system design as a preliminary design. Author

Automatic Landing Control; Reentry Vehicles; Experimentation

19970023006 Federal Aviation Administration, Cambridge, MA USA

Global Positioning System: A Guide for the Approval of GPS Receiver Installation and Operation ***Final Report, Apr. 1995 - Jun. 1996***

Wright, M., Federal Aviation Administration, USA; Oct. 1996; 350p; In English

Report No.(s): AD-A322317; DOT-VNTSC-FAA-96-18; FAA-P-8000-3; FAA-AFS,XH-400-1096; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This guide is designed to assist Federal Aviation Administration (FAA) Aviation Safety Inspectors (ASIs) in evaluating new Global Positioning Systems (GPS) installations and operations. Because there are many documents providing information, regulations, and guidelines for various types of CPS approvals, this guide has been created to provide one source for most FAA CPS approvals. This document contains aids such as flow charts and checklists to provide Principal Operations Inspectors (POIs) and Principal Avionics Inspectors (PAIs) with a consistent process for performing approvals. In addition, the relevant excerpts from regulation documents are included in references so inspectors will rarely need separate sources of information. This document will be updated periodically to maintain currency.

DTIC

Global Positioning System; Installing; Radio Receivers; Regulations; Education

19970023173 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Terminal Area Separation Standards: Historical Development, Current Standards, and Processes for Change

Thompson, Steven D., Massachusetts Inst. of Tech., USA; Jan. 16, 1997; 60p; In English

Contract(s)/Grant(s): DTFA01-93-Z-02012

Report No.(s): AD-A321801; ATC-258; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper gives an overview and summary of the separation requirements for air traffic control in the U.S. National Airspace System with emphasis on those relevant to terminal landing operations. These requirements are documented in the Federal Aviation Administration's (FAA' s) Air Traffic Control Order 711 O.65J, as amended, and various national and local Orders. These requirements are also addressed in the Aeronautical Information Manual, the International Civil Aviation Organization's Standards and Recommended Practices, and the Federal Aviation Regulations (FARs). The purpose of this paper is to assist those people involved with the introduction of new technologies and procedures in the terminal airspace by providing them with an understanding of the separation requirements, the need for those requirements, and the processes used to change the requirements. DTIC

Ground Based Control; Terminal Facilities; Air Traffic Control

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970022228 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

Methods of Designing Cooling Control Surfaces Based on Weight Minimization

Gao, Xinxu, China Aerospace Corp., China; Aero Weaponry; Oct. 09, 1996; Volume 2, No. 6, pp. 25-31; In English; Translated by Leo Kanner Associates

Contract(s)/Grant(s): F33657-88-D-2188

Report No.(s): AD-A321017; NAIC-ID(RS)T-0409-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper introduces the characteristics of cooling control surfaces and, based on analyzing their servovalves, driving devices, air collectors, and load matching, proposes some methods of designing cooling control surfaces based on weight minimization.
DTIC
Control Surfaces; Cooling; Aerodynamic Characteristics

19970022378 NASA Langley Research Center, Hampton, VA USA
Vertical Tail Buffeting Alleviation Using Piezoelectric Actuators-Some Results of the Actively Controlled Response of Buffet-Affected Tails (ACROBAT) Program
Moses, Robert W., NASA Langley Research Center, USA; Apr. 1997; 22p; In English
Contract(s)/Grant(s): RTOP 522-32-21-01
Report No.(s): NASA-TM-110336; NAS 1.15:110336; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Buffet is an aeroelastic phenomenon associated with high performance aircraft especially those with twin vertical tails. In particular, for the F/A-18 aircraft at high angles of attack, vortices emanating from wing/fuselage leading edge extensions burst, immersing the vertical tails in their wake. The resulting buffet loads on the vertical tails are a concern from fatigue and inspection points of view. Recently, a 1/6-scale F-18 wind-tunnel model was tested in the Transonic Dynamics Tunnel at the NASA Langley Research Center as part of the Actively Controlled Response of Buffet Affected Tails (ACROBAT) Program to assess the use of active controls in reducing vertical tail buffeting. The starboard vertical tail was equipped with an active rudder and the port vertical tail was equipped with piezoelectric actuators. The tunnel conditions were atmospheric air at Mach 0.10. by using single-input-single-output control laws at gains well below the physical limits of the actuators, the power spectral density of the root strains at the frequency of the first bending mode of the vertical tail was reduced by as much as 60 percent up to angles of attack of 37 degrees. Root mean square (RMS) values of root strain were reduced by as much as 19 percent. The results herein illustrate that buffet alleviation of vertical tails can be accomplished using simple active control of the rudder or piezoelectric actuators. In fact, as demonstrated herein, a fixed gain single input single output control law that commands piezoelectric actuators may be active throughout the high angle-of-attack maneuver without requiring any changes during the maneuver. Future tests are mentioned for accentuating the international interest in this area of research.
Author
Piezoelectricity; Buffeting; Active Control; Tail Assemblies; Supersonic Aircraft; Vortices; Angle of Attack; Aeroelasticity; Leading Edges; Root-Mean-Square Errors

19970022624 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Sensitivity Study of an AMRL Finite Element Model of the F-lll Lower Wing Skin Structural Detail at Forward Auxiliary Spar Station (FASS) 281.28
Keeley, D., Defence Science and Technology Organisation, Australia; Callinan, R., Defence Science and Technology Organisation, Australia; Sanderson, S., Defence Science and Technology Organisation, Australia; Sep. 1996; 29p; In English
Report No.(s): AD-A322102; DSTO-TN-0060; DODA-AR-009-909; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A baseline three-dimensional Finite Element (FE) model has been developed for a structural detail on an F-111 lower wing skin at Forward Auxiliary Spar Station (FASS) 281.28. This location has been the site of cracking in both RAAF and USAF aircraft The FE model was developed using precise thickness measurements appropriate for a specific full-scale test wing available at AMRL (serial number A-10-824). This document is a sensitivity study of the finite element model. The effects of small dimensional changes falling within the range of the manufacturing tolerances are investigated. This will allow a quantitative assessment of the stress variations which could be expected at that location within the F-111 fleet.
DTIC
Finite Element Method; Full Scale Tests; Three Dimensional Models; Wings; Mathematical Models

19970022727 Defence Science and Technology Organisation, Airframes and Engines Div., Canberra, Australia
Elastic/Plastic Finite Element Analysis of the F-111 Fuel Flow Vent Hole Number 13
Paul, J., Defence Science and Technology Organisation, Australia; Chapman, P., Defence Science and Technology Organisation, Australia; Searl, A., Defence Science and Technology Organisation, Australia; Nov. 1996; 93p; In English
Report No.(s): AD-A322078; DSTO-TR-0454; DODA-AR-009-944; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A detailed plasticity finite element stress analysis is presented for a fatigue critical location, at Fuel Flow Vent Hole #13 (FFVH #13) in the Wing Pivot Fitting of the Royal Australian Air Force's F-111 aircraft. The D6ac material behaviour was repre-

sented by a unified constitutive model which is considered to be particularly accurate for modeling plastic deformation through several cycles of non-symmetric loading. The aim of the present work is to generate the residual stress distributions following one (or more) applications of Cold Proof Load Test, as an input to the Durability and Damage Tolerance Analyses (DADTA) for FFVH #13. The mesh refinements and the selection of boundary conditions for a substructure model representing the immediate vicinity of FFVH #13 are discussed in detail. The results from the numerical analysis were correlated with full-scale wing test strain data and showed good agreement The residual stress distributions obtained here are considered to be significantly more accurate than what has previously been used for the DADTA of FFVH #13.
DTIC
F-111 Aircraft; Finite Element Method; Wings; Grid Generation (Mathematics); Numerical Analysis; Plastic Properties; Stress Analysis

19970022774 NYMA, Inc., Brook Park, OH USA
The NASA Lewis Research Center Water Tunnel Facility ***Final Report***
Wasserbauer, Charles A., NYMA, Inc., USA; Jul. 1997; 16p; In English
Contract(s)/Grant(s): NAS3-27186; RTOP 523-36-13
Report No.(s): NASA-CR-4777; NAS 1.26:4777; E-10756; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A water tunnel facility specifically designed to investigate internal fluid duct flows has been built at the NASA Research Center. It is built in a modular fashion so that a variety of internal flow test hardware can be installed in the facility with minimal facility reconfiguration. The facility and test hardware interfaces are discussed along with design constraints for future test hardware. The inlet chamber flow conditioning approach is also detailed. Instrumentation and data acquisition capabilities are discussed. The incoming flow quality has been documented for about one quarter of the current facility operating range. At that range, there is some scatter in the data in the turbulent boundary layer which approaches 10 percent of the duct radius leading to a uniform core.
Author
Water Tunnel Tests; Design Analysis; Fluid Flow; Inlet Flow; Internal Flow; Ducts

19970022881 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Canberra, Australia
A Database Compiler for Flight Dynamic Applications
Hill, S. D., Defence Science and Technology Organisation, Australia; Dec. 1996; 37p; In English
Report No.(s): AD-A322056; DSTO-TN-0064; DODA-AR-009-926; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a database system developed by the Air Operations Division (AOD) for aircraft flight dynamic models. A new database format has been established to meet AOD's flight dynamic and performance requirements. A program has been written to create program source code to read and interpolate/extrapolate data stored in the database format. The major advantage of the new database format is that all the information required to read and interpolate/extrapolate a data set is contained within the database. This report describes (1) a typical example of the database format, (2) technical descriptions of the syntax, (3) methods of interpolation/extrapolation, (4) method of database interfacing, and (5) procedures for database use.
DTIC
Data Bases; Dynamic Models; Aircraft Models

19970023172 National Aerospace Lab., Amsterdam, Netherlands
Variation in Load Factor Experience of Fokker F27 and F28 Operational Acceleration Exceedance Data ***Final Report***
deJonge, J. B., National Aerospace Lab., Netherlands; Hol, P. A., National Aerospace Lab., Netherlands; Dec. 1996; 48p; In English
Report No.(s): AD-A322927; NLR-TP-96512-L; DOT/FAA/AR-96/114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fatigue meter data obtained during operational flights of Fokker F27 and F28 aircraft were reprocessed and analyzed to study the variation in load experience between different aircraft of the same type. The data covered about 470,000 flights which were made by 101 aircraft belonging to 51 different operators. A simple algorithm was developed to quantify the load factor experience in terms of fatigue damage per flight. The data were subjected to a statistical analysis. Considerable variations in load experience were found. The results give an indication of the benefits that can be gained from individual aircraft load monitoring.
DTIC
Fatigue (Materials); Fokker Aircraft; Flight Tests; Commercial Aircraft; Aerodynamic Loads; Statistical Analysis; Structural Analysis

19970023178 Defence Science and Technology Organisation, Air Operations Div., Canberra, Australia

Data Link Technology for a Portable Unmanned Aerial Vehicle ***Topical Report***

Kowalenko, Victor, Defence Science and Technology Organisation, Australia; Phipps, Jane, Defence Science and Technology Organisation, Australia; Cameron, Keith, Defence Science and Technology Organisation, Australia; Nov. 1996; 66p; In English

Report No.(s): AD-A322043; DSTO-RR-0087; DODA-AR-009-761; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report examines data link requirements for a portable unmanned aerial vehicle. Crucial to the operation of such a data link is the development of suitable computer algorithms that are capable of significantly compressing and reconstructing image data in a timely manner for viewing at a remote station. As a consequence of the near real time requirement, we investigate recent advances in lossy data compression techniques concentrating on transform coding techniques involving the discrete cosine transform, fractals and wavelets. At present the discrete cosine transform is available on a microprocessor chip and can offer acceptable reconstructed images close to real time with compression ratios of up to 35 :1, but other techniques promise even higher compression ratios and possibly a near real time capability in the not too distant future.

DTIC

Pilotless Aircraft; Data Links; Data Compression; Real Time Operation; Compression Ratio

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19970022628 Defence Science and Technology Organisation, Airframes and Engines Div., Canberra, Australia

P-3C On-Wing Trial of a Data Logger for T56 Turbine Inlet Temperature Monitoring System

Dutton, S. A., Defence Science and Technology Organisation, Australia; Sep. 1996; 20p; In English

Report No.(s): AD-A322149; DSTO-TN-0056; DODA-AR-009-883; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Following successful ground based on-wing trials on a C-130H aircraft, a commercial data acquisition system, the DataTaker DT220, was tested at RAAF Base Edinburgh on a P-3C on the ground to determine its suitability as a flight demonstrator for a T56 engine individual turbine inlet temperature monitoring system.

DTIC

Data Acquisition; Turboprop Engines; P-3 Aircraft; Transport Aircraft; Flight Recorders; Inlet Temperature; Flight Tests

19970023139 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Developments in Missile Ramjet Propulsion

Calzone, R. F., Prins Maurits Lab. TNO, Netherlands; Dec. 1996; 79p; In English

Contract(s)/Grant(s): A95KLu-487

Report No.(s): AD-A322627; PML-1996-A100; TDCK-TD96-0427; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

At the request of the Royal Netherlands Air Force, a study into the international developments on missile ramjet propulsion has been carried out. It is the objective of this work to provide an outline of ramjet propulsion for missiles with a view on technical and operational aspects as well as the ongoing international developments. The essential areas for employment of missile systems, which are presently insufficiently perceived for ramjet missile systems, have been identified in accordance with the Royal Netherlands Air Force. Future work on these areas will be defined in consensus with the Royal Netherlands Air Force.

DTIC

Ramjet Missiles; Guidance (Motion); Missiles; Propulsion System Performance; Ramjet Engines

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19970022450 Institute for Human Factors TNO, Soesterberg, Netherlands
Computer Generated Environment for Steering a Simulated Unmanned Aerial Vehicle ***Final Report Computer gegenereerde omgeving voor het besturen van een gesimuleerd onbemand voertuig***
vanErp, J. B., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Oct. 01, 1996; 35p; In English
Report No.(s): AD-A321053; TNO-TM-96-A039; TDCK-RP-96-0179; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two important tasks in operating a Maritime Unmanned Aerial Vehicle (MUAV) are controlling the airframe and its onboard camera. However, the visual information on which the human operator has to perform these tasks is of poor quality, due to the restricted capacity of the down link between MUAV and operator. This leads to performance degradation in search and tracking tasks and loss of situational awareness. In previous experiments, it was shown that augmentation of the camera image by adding a Computer Generated Environment (CGE) improves performance in controlling the camera and enlarges situational awareness. The present experiment focuses on the possibilities of operating both the airframe and the onboard camera simultaneously, e.g. tracking a target ship while flying a circle around it. The experiment compared performance in four display type conditions: two without augmentation (respectively north up and heading up), and two with augmentation (respectively a 2D CGE and a 3D CGE). The resuLts show that the CGE is successful in supporting airframe controL, without affecting tracking performance. No differences were found between the 2D and 3D CGE, and no differences were found between the north up and heading up displays without CGE. On the basis of these results, it is recommended to investigate the effects of integrating more information into the CGE (i.e. electronic maps), and to explore the possibilities of switching between 2D and 3D. Moreover, more basic knowledge should be acquired concerning the (visual) perception and discrimination of combined airframe, camera, and target motions.
DTIC
Computer Programs; Remotely Piloted Vehicles; Environment Models; Pilotless Aircraft

19970022591 Old Dominion Univ., Aerospace Engineering Dept., Norfolk, VA USA
Twin Tail/Delta Wing Configuration Buffet Due to Unsteady Vortex Breakdown Flow
Kandil, Osama A., Old Dominion Univ., USA; Sheta, Essam F., Old Dominion Univ., USA; Massey, Steven J., Old Dominion Univ., USA; 1996; 16p; In English
Contract(s)/Grant(s): NAG1-648; NAG1-994
Report No.(s): NASA-CR-203258; NAS 1.26:203258; AIAA Paper 96-2517; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The buffet response of the twin-tail configuration of the F/A-18 aircraft; a multidisciplinary problem, is investigated using three sets of equations on a multi-block grid structure. The first set is the unsteady, compressible, full Navier-Stokes equations. The second set is the coupled aeroelastic equations for bending and torsional twin-tail responses. The third set is the grid-displacement equations which are used to update the grid coordinates due to the tail deflections. The computational model consists of a 76 deg-swept back, sharp edged delta wing of aspect ratio of one and a swept-back F/A-18 twin-tails. The configuration is pitched at 32 deg angle of attack and the freestream Mach number and Reynolds number are 0.2 and 0.75 x 10(exp 6) respectively. The problem is solved for the initial flow conditions with the twin tail kept rigid. Next, the aeroelastic equations of the tails are turned on along with the grid-displacement equations to solve for the uncoupled bending and torsional tails response due to the unsteady loads produced by the vortex breakdown flow of the vortex cores of the delta wing. Two lateral locations of the twin tail are investigated. These locations are called the midspan and inboard locations.
Author
Aerodynamic Configurations; Delta Wings; Buffeting; Unsteady Flow; Vortex Breakdown; Multiblock Grids; Aeroelasticity; Angle of Attack; Navier-Stokes Equation

19970022592 NASA Langley Research Center, Hampton, VA USA
Computation and Validation of Fluid/Structure Twin Tail Buffet Response
Massey, Steven J., Old Dominion Univ., USA; Kandil, Osama A., Old Dominion Univ., USA; Sheta, Essam F., Old Dominion Univ., USA; Liu, C. H., NASA Langley Research Center, USA; 1996; 14p; In English; 14th; Applied Aerodynamics, 18-20 Jun. 1996, New Orleans, LA, Goettingen, USA, Germany; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-994

Report No.(s): NASA-CR-203259; NAS 1.26:203259; AIAA CP-96-2517; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The buffet response of the flexible twin-tail/delta wing configuration, a multidisciplinary problem, is solved using three sets of equations on a multi-block grid structure. The first set is the unsteady, compressible, full Navier-Stokes equations which are used for obtaining the flow-field vector and the aerodynamic loads on the twin tails. The second set is the coupled aeroelastic equations which are used for obtaining the bending and torsional deflections of the twin tails. The third set is the grid-displacement equations which are used for updating the grid coordinates due to the tail deflections. The computational model is similar to the one used by Washburn et. al. which consists of a delta wing of aspect ratio one and twin tails with taper ratios of 0.23. The vortex of the twin tails are located at the wing trailing edge. The configuration is pitched at 30 deg angle of attack, and the freestream Mach number and Reynolds number are 0.3 and 1.25 million, respectively. With the twin tails fixed as rigid surfaces, the problem is solved for the initial flow conditions. Next, the problem is solved for the twin tail response for uncoupled bending and torsional vibrations due to the unsteady loads produced by the vortex breakdown flow of the leading-edge vortex cores. The configuration is investigated for three spanwise positions of the twin tails; inboard, midspan and outboard locations. The computational results are validated and are in very good agreement with the experimental data of Washburn, et. al.

Author

Buffeting; Multiblock Grids; Navier-Stokes Equation; Computational Fluid Dynamics; Aeroelasticity; Tail Assemblies; Delta Wings; Angle of Attack

19970022856 Institute for Human Factors TNO, Soesterberg, Netherlands

Automatic Speech Recognition Performance in a Simulation-Based Fast-Jet Cockpit Application ***Interim Report Automatische spraakherkenning toegepast voor controletaken in de cockpit van een jachtvliegtuig***

Steeneken, H. J., Institute for Human Factors TNO, Netherlands; Kriekaard, J. J., Institute for Human Factors TNO, Netherlands; vanLeeuwen, D. A., Institute for Human Factors TNO, Netherlands; Nov. 28, 1996; 20p; In English

Report No.(s): AD-A321974; TNO-TM-96-A053; TDCK-RP-96-0196; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A project on automatic speech recognition for control of systems in a fast-jet cockpit was conducted by the TNO Human Factors Research Institute (TNO-HFRI) and the National Aerospace Laboratory (NLR). The project comprised performance testing in an advanced fast jet simulator. In total the results of 17 sorties, performed by three experienced pilots, are presented. During each sortie the pilot had access to a control by voice of radio systems, displays and HOTAS functions. During the flight tests recordings were made of the speech signals and a video recording of the pilot actions. Analysis of all pilot actions including the voice control and debriefing was performed by the NLR and is reported separately. In this report the recognizer performance is analyzed. It was found that under these simulator flight conditions the performance (accuracy) drops from over 0.95 for read speech to 0.69 for the simulator spontaneous speech condition. Results obtained in four flight experiments performed in other laboratories showed similar results for read speech (three experiments) and for spontaneous speech (one experiment). From the original 281 word vocabulary only 65 words were used frequently by the pilots. These 65 words had a coverage of 90% of all words used during the tests. This means that the complexity of the recognition process can be reduced, which will lead to a better performance of the recognizer. From the speech material a calibrated data base was built with all the speech utterances annotated orthographically at command string level. A pilot study was performed with a modern phoneme/grammar based recognizer. With this speaker independent system a mean performance of 0.85 (accuracy) was obtained. It is expected that this performance will exceed the 0/95 if this type of recognizer is trained for the non-native English speaking pilots.

DTIC

Cockpits; Voice Control; Speech Recognition; Performance Tests; Human Factors Engineering; Automatic Control; Aircraft Pilots; Access Control

19970022857 Institute for Human Factors TNO, Soesterberg, Netherlands

Development and Performance of a Cockpit Control System Operated by Voice: Summary Report of Project DMKLu/ACO2/A/9lO5, Phase 3 ***Final Report Ontwikkeling en Prestatie van een Door Spraak Cockpit-Besturingssysteem: Samenvattingsrapportage van Fase 3 van her Project DMKLu/AC02/A/9105***

Steeneken, H. J., Institute for Human Factors TNO, Netherlands; Nov. 29, 1996; 16p; In English

Report No.(s): AD-A321975; TNO-TM-96-A055; TDCK-RP-96-0198; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Phase 3 of this project is concerned with the evaluation of an automatic speech recognizer for cockpit control functions in the MLU-F-16. The report is a summary of the following 3 reports: (1) Automatic speech recognition performance in a simulation-based fast-jet cockpit application, (2) Spontaneous-speech data base for cockpit control applications applied to commercial state-

of-the-art speech recognition technology, and (3) Evaluation of integrated automatic speech recognition on the WSF mid-life update F-16 simulator. A total of 29 sessions were flown during shake-down and training stages yielding 32.5 hours of recording. In 17 of these sorties three RWLAF pilots were participating. The overall achieved word recognition accuracy was around 0.69, with scores per session ranging 0.53 to 0.88. The average completion rate (i.e. correctly executed commands) was around 66%. This is a low performance and insufficient for the envisioned operational applications. The pilot debriefing information learned that although the performance was considered insufficient, the expansion of functions, such as radio station selection by name, was highly appreciated. In general the present syntax was too complex which lead to incorrect commands. Also the awareness of the node status of the recognizer was marginal. A more flexible command language is an important requirement. With the recorded speech signals of 17 sorties a data base was compiled. With this data base a repetition of the recognition experiments can b e made with different types of recognizers. Assessment of a new large vocabulary speech recognizer which was trained for the grammar (command string construction) of the cockpit commands produced a significantly higher recognition performance (0.87).
DTIC
F-16 Aircraft; Cockpits; Control Theory; Control

19970022891 NASA Langley Research Center, Hampton, VA USA
Evaluation of the Low-Speed Stability and Control Characteristics of a Mach 5.5 Waverider Concept
Hahne, David E., NASA Langley Research Center, USA; May 1997; 28p; In English
Contract(s)/Grant(s): RTOP 505-70-69-01
Report No.(s): NASA-TM-4756; L-17581; NAS 1.15:4756; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Static force and moment tests of a 0.062-scale model of a hypersonic vehicle study concept known as the LOFLYTE(TM) configuration were conducted in the Langley 12-Foot Low-Speed Tunnel. These tests looked primarily at the low-speed static stability and control characteristics of this configuration. Data were obtained over an angle-of-attack range of -5 deg. to 22 deg. at sideslip angles that ranged between -10 deg. and 10 deg. The tiperons were sized to provide enough pitch control to trim the vehicle up to alpha = 16 deg. with no more than 10 deg. of surface deflection and data obtained in this test showed that 10 deg. of tiperon deflection was nearly sufficient to trim the configuration up to the desired angle of attack. Because of the pitching-moment characteristics of the LOFLYTE(TM) configuration, there is a reasonably high level of unpowered trimmed lift at nominal takeoff and approach to landing that should allow for acceptable takeoff and landing speeds for this vehicle. Initial evaluation of the directional stability characteristics of this configuration showed a significant instability between alpha = 10 deg. and about alpha = 18 deg. This test determined that the cause of this instability was the interaction of the wing leading-edge vortex with the vertical tails. Moving the vertical tails either inboard or outboard from the baseline location eliminated this unfavorable interaction.
Author
Hypersonic Vehicles; Hypersonic Speed; Angle of Attack; Waveriders; Stabilizers (Fluid Dynamics); Pitching Moments; Vortices; Wind Tunnel Stability Tests; Stability; Low Speed; Mach Number; Aerodynamic Characteristics; Aerodynamic Coefficients; Aerodynamic Stability

19970022947 Army Aviation Systems Command, Aeroflightdynamics Directorate, Moffett Field, CA USA
CONDUIT: A New Multidisciplinary Integration Environment for Flight Control Development
Tischler, Mark B., Army Aviation Systems Command, USA; Colbourne, Jason D., California Polytechnic State Univ., USA; Morel, Mark R., California Polytechnic State Univ., USA; Biezad, Daniel J., California Polytechnic State Univ., USA; Levine, William S., Maryland Univ., USA; Moldoveanu, Veronica, Maryland Univ., USA; Jun. 1997; 26p; In English
Contract(s)/Grant(s): RTOP 505-59-36
Report No.(s): NASA-TM-112203; NAS 1.15:112203; A-976615A; USAATCOM-TR-97-A-009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A state-of-the-art computational facility for aircraft flight control design, evaluation, and integration called CONDUIT (Control Designer's Unified Interface) has been developed. This paper describes the CONDUIT tool and case study applications to complex rotary- and fixed-wing fly-by-wire flight control problems. Control system analysis and design optimization methods are presented, including definition of design specifications and system models within CONDUIT, and the multi-objective function optimization (CONSOL-OPTCAD) used to tune the selected design parameters. Design examples are based on flight test programs for which extensive data are available for validation. CONDUIT is used to analyze baseline control laws against pertinent military handling qualities and control system specifications. In both case studies, CONDUIT successfully exploits trade-offs between forward loop and feedback dynamics to significantly improve the expected handling, qualities and minimize the required

actuator authority. The CONDUIT system provides a new environment for integrated control system analysis and design, and has potential for significantly reducing the time and cost of control system flight test optimization.
Author
Applications Programs (Computers); Control Systems Design; Systems Analysis; Fly by Wire Control; Control Theory; Cost Reduction; Optimization

19970022980 NASA Dryden Flight Research Center, Edwards, CA USA
Emergency Flight Control Using Only Engine Thrust and Lateral Center-of-Gravity Offset: A First Look
Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Burken, John, NASA Dryden Flight Research Center, USA; Maine, Trindel A., NASA Dryden Flight Research Center, USA; Bull, John, Caelum Research Corp., USA; Jul. 1997; 20p; In English; 33rd; Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 522-15-34-00-39-00
Report No.(s): NASA-TM-4798; H-2176; NAS 1.15:4798; AIAA Paper 97-3189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Normally, the damage that results in a total loss of the primary flight controls of a jet transport airplane, including all engines on one side, would be catastrophic. In response, NASA Dryden has conceived an emergency flight control system that uses only the thrust of a wing-mounted engine along with a lateral center-of-gravity (CGY) offset from fuel transfer. Initial analysis and simulation studies indicate that such a system works, and recent high-fidelity simulation tests on the MD-11 and B-747 suggest that the system provides enough control for a survivable landing. This paper discusses principles of flight control using only a wing engine thrust and CGY offset, along with the amount of CGY offset capability of some transport airplanes. The paper also presents simulation results of the throttle-only control capability and closed-loop control of ground track using computer-controlled thrust.
Author
MD 11 Aircraft; Boeing 747 Aircraft; Controllability; Center of Gravity; Numerical Control; Feedback Control; Emergencies

19970023126 Naval Postgraduate School, Dept. of Aeronautics and Astronautics, Monterey, CA USA
Uniform System for the Rapid Prototyping and Testing of Controllers for Unmanned Aerial Vehicles
Zanino, James A., Naval Postgraduate School, USA; Sep. 1996; 97p; In English
Report No.(s): AD-A322382; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The field of control systems has witnessed an explosion in state-space techniques addressing a variety of critical design issues facing control engineers today. Modem computational tools, such as the MATRIX(x) Product Family developed by Integrated Systems Incorporated, allow the designer to quickly design, test and implement control systems based on these state-space techniques. These new computing advances shorten the time required to complete a control design from a few years to a few months. However, as the design process progressed new inputs and outputs were required, which usually resulted in a confusing mess of connections that were hard to follow. Therefore, a universal system was needed that could be used on any controller design to aid in the understanding and tracking of the controller's inputs and outputs. A description of this system is given along with a detailed step by step process on how it was implemented on a Unmanned Air Vehicle (UAV).
DTIC
Pilotless Aircraft; Controllers; Computer Programs

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970022284 Old Dominion Univ., Research Foundation, Norfolk, VA USA
Large Angle Magnetic Suspension Test Fixture ***Final Report, 1 Nov. 1995 - 31 Oct. 1996***
Britcher, Colin P., Old Dominion Univ., USA; Huang, Jen-Kuang, Old Dominion Univ., USA; Jan. 09, 1997; 30p; In English
Contract(s)/Grant(s): NAG1-1056
Report No.(s): NASA-CR-203234; NAS 1.26:203234; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Progress in the areas of eddy current computations, modelling and analysis, design optimization methods, wind tunnel Magnetic Suspension and Balance Systems (MSBS), payload pointing and vibration isolation systems, and system identification is

reported. Research accomplishments facilitated the demonstration of several new developments in the field of magnetic suspension technology.
Derived from text
Magnetic Suspension; Eddy Currents; Design Analysis; Vibration Isolators; System Identification; Pointing Control Systems

19970023170 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA
Flight Simulator Evaluation of a Novel Display to Minimize the Risks of Spatial Disorientation ***Final Report***
Braithwaite, Malcolm G., Army Aeromedical Research Lab., USA; Durnford, Simon J., Army Aeromedical Research Lab., USA; DeRoche, Shannon L., Army Aeromedical Research Lab., USA; Alvarez, Eduardo A., Army Aeromedical Research Lab., USA; Jones, Heber D., Army Aeromedical Research Lab., USA; Feb. 1997; 168p; In English
Contract(s)/Grant(s): DA Proj. 3M1-62787-A8-79
Report No.(s): AD-A322607; USAARL-97-11; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A novel instrument display designed to reduce cognitive workload and improve accuracy of flight and recovery from a disorienting episode was tested against flight with standard instruments in a UH-60 dynamic helicopter simulator. Sixteen non-UH-60 rated pilots flew a standard instrument profile and recovered from a series of unusual attitudes both with and without a secondary task. Results from all aspects of the assessment proved the benefits of the new display. Not only was there evidence of enhanced flight control, but also an improved performance on a secondary task (auditory tone identification), and reduced control input errors. Evidence from analysis of the secondary task scores showed that cognitive workload was reduced when using the novel display compared to the standard instruments. The display should be further developed to make it possible to utilize it in a head-up display or other night vision device. It should also be developed to include the capability to display hover information and an instrument landing system. Future testing should be carried out in real flight.
DTIC
Flight Simulators; Evaluation; Risk; Disorientation; Attack Aircraft; Human Factors Engineering; Physics and Chemistry Experiment In Space

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19970022253 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
Selected Articles
Transl. into ENGLISH of Daodan Yu Hangtian Yunzai Jishu (China) p1-8, 18-63, 74-80, n.d; Jan. 1997; 138p; In English; Translated into English by Leo Kanner Associates
Contract(s)/Grant(s): F33657-88-D-2188
Report No.(s): AD-A321319; NAIC-ID(RS)T-0502-96; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The corridor and trajectories of space vehicles during reentry flight using negative lift are studied. Numerical results are obtained for the corridors and trajectories using negative and positive lift, respectively. The following conclusions are obtained: in the case of a larger lift-drag ratio, the first one-third reentry corridor using negative lift is wider than that using positive lift; the total mass cost (TMC) by negative lift is smaller than that for positive lift, where TMC is the total mass of fuel consumed for the vehicle to deorbit from the mission orbit and the mass of the thermal protection system of the vehicle, in the case of a smaller lift-drag ratio. The two kinds of reentry trajectories produced by positive lift and negative lift are approximately the same. Therefore, the concept of return flight using negative lift is superior to that using positive lift.
DTIC
Reentry Trajectories; Spacecraft Trajectories; Lift

19970022307 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
Selected Articles
Daodan Yu Hangtian Yunzai Jishu; Jan. 1997, pp. 1-8; 18-63; 74-80; In English; Translated into English by Leo Kanner Associates
Contract(s)/Grant(s): F33657-88-D-2188
Report No.(s): AD-A321317; NAIC-ID(RS)T-0502-96; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The corridor and trajectories of space vehicles during reentry flight using negative lift are studied. Numerical results are obtained for the corridors and trajectories using negative and positive lift, respectively. The following conclusions are obtained: in the case of a larger lift-drag ratio, the first one-third reentry corridor using negative lift is wider than that using positive lift; the total mass cost (TMC) by negative lift is smaller than that for positive lift, where TMC is the total mass of fuel consumed for the vehicle to deorbit from the mission orbit and the mass of the thermal protection system of the vehicle, in the case of a smaller lift-drag ratio. The two kinds of reentry trajectories produced by positive lift and negative lift are approximately the same. Therefore, the concept of return flight using negative lift is superior to that using positive lift.
DTIC
Reentry Trajectories; Spacecraft Trajectories; Lift

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19970022824 Nippon Bunri Univ., Dept. of Aeronautical Engineering, Japan
Initiation and Propagating Behaviors of Surface Fatigue Cracks in 2017-T4 Aircraft Structural Aluminium Alloy
Kawano, Koken, Nippon Bunri Univ., Japan; Yasuda, Sachio, Nippon Bunri Univ., Japan; Kuwabara, Toshihisa, Nippon Bunri Univ., Japan; Yonezawa, Makoto, Nippon Bunri Univ., Japan; Bulletin of Nippon Bunri University; Oct. 1993; Volume 21, No. 2, pp. 19-26; In Japanese; Also announced as 19970022823; No Copyright; Avail: Issuing Activity (Nippon Bunri Univ., Japan), Hardcopy, Microfiche

The effect of bending and torsional fatigue loading on the crack initiation and propagation is investigated for a 2017-T4 aircraft structural aluminum alloy. Microcracks were observed with the aid of SEM. The following conclusions are drawn: (1) Based on the relation between the crack length and the logarithm of fatigue life, the crack propagation ratios are almost identical for the same stress levels; (2) the relation between the crack propagation speed and the stress intensity factor are almost linear; and (3) based on the dl/dn - delta K relation, the material constant m is approx. 3.27.
Author
Aluminum Alloys; Crack Initiation; Crack Propagation; Fatigue (Materials); Aircraft Structures; Surface Cracks; Microcracks

19970023094 AVRO International Aerospace, Post Station 38, Woodford, UK
Qualification of Chromate-Free Primers for Application to Aircraft Structure
Higgins, A., AVRO International Aerospace, UK; Feb. 1997; 10p; In English; Also announced as 19970023078; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Paint primers used on metallic aircraft structure are the major contributing element in the protection of the structure against corrosion. Qualification testing of primers for use on aircraft structure is therefore aimed at assessing if adequate service performance can be achieved. All assessors use accelerated degradation testing based on long term immersion in fluids to which the aircraft structure will be subjected in service, thermal cycling, exposure to high humidity and various corrosion tests. Accelerated corrosion testing is the primary method used in most qualification specifications for assessing service life expectancy of the primed metallic surface. The variability of service conditions and the lack of precise data of service life to corrosion test performance make this assessment subjective. The general performance of chromated primers in service can be used to compare respective accelerated corrosion test performance of alternative primers. Consideration needs to be given to the fact that chromated primers are capable of protecting structure for well past the airframe service life in most areas. This means that chromate-free alternatives with lower accelerated test performance could be considered for areas of the structure where the performance in service is assessed to be adequate. The variation in approach to assessment and in the test methods used by different airframe manufacturers and those called up in national specifications needs to be rationalized and better defined if the primer manufacturers are to be able to provide the airframe industry with a suitable chromate-free alternative primer.
Author
Aircraft Structures; Accelerated Life Tests; Corrosion Tests; Metal Surfaces; Primers (Coatings); Paints; Environment Protection

19970023160 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Luminescent Paint for Pressure and Temperature Measurements on Rotating Machinery *Final Report*
Sullivan, John, Purdue Univ., USA; Liu, Tianshu, Purdue Univ., USA; Burns, Steve, Purdue Univ., USA; Campbell, Bryan, Purdue Univ., USA; Dec. 30, 1996; 94p; In English

Contract(s)/Grant(s): F49620-95-I-0031
Report No.(s): AD-A322692; AFOSR-97-0127TR; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report is an overview of the current state of temperature- and pressure-sensitive luminescent paint techniques. Topics include photophysical foundations, paint preparation and calibration, measurement systems, accuracy, and time response. Applications of the luminescent paint technique in aerodynamic testing are discussed and results of measurements of a transonic rotor are presented.

DTIC

Rotation; Wind Tunnel Tests; Rotors; Compressors; Aerodynamic Characteristics; Paints; Transonic Flow; Luminescence

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970022205 NASA Ames Research Center, Moffett Field, CA USA

Measurement of Air Flow Characteristics Using Seven-Hole Cone Probes

Takahashi, Timothy T., NASA Ames Research Center, USA; May 1997; 60p; In English
Contract(s)/Grant(s): RTOP 505-59-53
Report No.(s): NASA-TM-112194; NAS 1.15:112194; A-976463A; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The motivation for this work has been the development of a wake survey system. A seven-hole probe can measure the distribution of static pressure, total pressure, and flow angularity in a wind tunnel environment. The author describes the development of a simple, very efficient algorithm to compute flow properties from probe tip pressures. Its accuracy and applicability to unsteady, turbulent flow are discussed.

Author

Air Flow; Flow Characteristics; Pressure Distribution; Static Pressure; Wind Tunnels; Unsteady Flow

19970022325 Wright Lab., Fan and Compressor Branch, Wright-Patterson AFB, OH USA

Vibrational Analysis of a 1/4 inch Stainless Steel Kulite Probe ***Final Report, Aug. 1993 - Jan. 1995***

Cunningham, Cameron C., Wright Lab., USA; Oct. 1996; 53p; In English
Contract(s)/Grant(s): AF Proj. 2307
Report No.(s): AD-A321086; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the techniques, equipment, and results from the analysis of the frequency response of the 1/4 inch stainless-steel traversing Kulite probe used in the Compressor Aero Research Facility. Through the use of a shake table, the experimental response of the probe was found and compared to a theoretical model.

DTIC

Gas Turbines; Turbocompressors; Vibration Effects; Frequency Response; Pressure Sensors

19970022522 Sandia National Labs., Albuquerque, NM USA

Visual Inspection Research Project Report on Benchmark Inspections ***Final Report***

Spencer, Floyd W., Sandia National Labs., USA; Oct. 1996; 59p; In English
Report No.(s): AD-A321199; DOT/FAA/AR-96/65; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recognizing the importance of visual inspection in the maintenance of the civil air fleet, the FAA tasked the Aging Aircraft Nondestructive Inspection Validation Center (AANC) at Sandia National Labs in Albuquerque, NM, to establish a visual inspection reliability program. This report presents the results of the first phase of that program, a benchmark visual inspection reliability experiment. The benchmark experiment had 12 airline inspectors perform specific inspection tasks on AANC's Boeing 737 in order to estimate overall performance characteristics of a typical set of inspectors on a typical set visual inspection tasks. The report also includes a separate but related probability of detection study on small but visible cracks at rivet locations on fabricated fuselage skin splices. Conclusions are drawn with respect to quantification of inspection reliability, search and decision aspects of visual inspection, use of job cards during inspection, and inspector specific factors affecting visual inspection performance.

DTIC

Aircraft Maintenance; Nondestructive Tests; Airline Operations; Boeing 737 Aircraft; Inspection; Visual Tasks

19970022580 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Beacon Radar and TCAS Reply Rates: Airborne Measurements in the 1090 MHz Band

Harman, William H., Massachusetts Inst. of Tech., USA; Brennan, Martin J., Massachusetts Inst. of Tech., USA; Jan. 29, 1997; 40p; In English

Contract(s)/Grant(s): F19628-95-C-0002; DTFA01-93-Z-02012

Report No.(s): AD-A321599; ATC-256; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Aviation Administration (FAA) is in the process of developing Automatic Dependent Surveillance Broadcast (ADS-B) techniques. In one candidate system, GPS-Squitter, each aircraft periodically broadcasts messages, called 'squitters,' that report the aircraft's identification, position, and velocity. The position and velocity information may be obtained from the Global Positioning System (GPS). Reception of squitters can be used for several purposes, including surveillance of airborne aircraft by a ground station, surveillance of aircraft on the airport surface, and air-to-air surveillance. In developing the new system, it is necessary to know the rates of existing signal transmissions in the 1030 and 1090 MHz frequency bands, which are the beacon-radar and TCAS interrogation and reply channels. The GPS-Squitter would be transmitted in the 1090 MHz band, like a reply. A key issue is the possibility of interference to squitter reception from existing signals in the 1090 MHz band. to validate initial calculations, Lincoln Laboratory is making direct measurements of the rates of existing transmissions in both hands. This report describes the measurements in the 1090 MHz band. An instrumented aircraft was flow n from Boston to New York and other locations while recording 1090 MHz receptions. The data has been processed to show the reception rates for Mode S replies and, separately, ATCRBS replies. The results have been plotted to show received rates vs. time and location. Results of this kind are given for Boston, New York, Philadelphia, Atlanta, Dallas, Lakeland FL, and the Los Angeles Basin. The results have also been used to support analyses of GPS-Squitter performance under current conditions and projected into the future.

DTIC

Air Traffic Control; Radar Beacons; Aircraft Safety; Signal Transmission; Measuring Instruments

19970022698 NASA Langley Research Center, Hampton, VA USA

Structural Test Documentation and Results for the McDonnell Douglas All-Composite Wing Stub Box

Jegley, Dawn C., NASA Langley Research Center, USA; Bush, Harold G., NASA Langley Research Center, USA; Apr. 1997; 102p; In English

Contract(s)/Grant(s): RTOP 538-10-11-06

Report No.(s): NASA-TM-110204; NAS 1.15:110204; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The results of a series of tests conducted at the NASA Langley Research Center to evaluate the behavior of an all-composite full-scale wing box are presented. The wing stub box is representative of a section of a commercial transport aircraft wing box and was designed and constructed by McDonnell Douglas Aerospace Company as part of the NASA Advanced Composites Technology (ACT) program. Tests were conducted with and without low-speed impact damage and repairs. The structure with nonvisible impact damage carried 140 percent of Design Limit Load prior to failure through an impact site.

Author

Impact Damage; Composite Structures; Wings; Loads (Forces); Commercial Aircraft; Failure; Composite Materials

19970022901 Princeton Univ., NJ USA

Turbulent Reacting Flows at High Speed ***Final Report, 1 Sep. 1993 - 31 Aug. 1996***

Smits, Alexander J., Princeton Univ., USA; Dryer, Frederick L., Princeton Univ., USA; Fielding, J., Princeton Univ., USA; Sep. 30, 1996; 22p; In English

Contract(s)/Grant(s): F49620-93-I-0478; AF Proj. 3484

Report No.(s): AD-A322023; AFOSR-TR-97-0097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A pilot-scale supersonic combustion tunnel was designed and constructed to operate with initial stagnation temperatures up to 900 K and static pressure and stagnation temperature ranges of 0.01-0.1 atm. and 290-900 K, respectively, in the test chamber without vitiation of the nitrogen/oxygen gas supply. Through the addition of hydrogen in the upstream settling chamber, the effective operating stagnation temperature in the test section was extended to 1100 K. The tunnel facility was instrumented with a Schlieren/shadowgraph system and charge-coupled device (CCD) intensified imaging of chemiluminescence from excited state hydroxyl radicals to study the initiation and combustion properties of nitrogen-diluted hydrogen/oxygen mixtures under Mach 3.0 flow conditions over both flat plate and wedge-shaped center bodies. Reaction initiation by recovery effects on noncatalytic and catalytic surfaces, as well as through seeding of the flow with radicals, was investigated.

DTIC

Supersonic Wind Tunnels; Turbulent Flow; Supersonic Combustion; Imaging Techniques; Operating Temperature; Chemiluminescence; Hydroxyl Radicals; Reacting Flow

19970022945 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

The Effect of Three-Dimensional Freestream Disturbances on the Supersonic Flow Past a Wedge ***Final Report***

Duck, Peter W., Manchester Univ., UK; Lasseigne, D. Glenn, Old Dominion Univ., USA; Hussaini, M. Y., Florida State Univ., USA; Jun. 1997; 32p; In English

Contract(s)/Grant(s): NAS1-19480; RTOP 505-90-52-01

Report No.(s): NASA-CR-201698; NAS 1.26:201698; ICASE-97-26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The interaction between a shock wave (attached to a wedge) and small amplitude, three-dimensional disturbances of a uniform, supersonic, freestream flow are investigated. The paper extends the two-dimensional study of Duck et al, through the use of vector potentials, which render the problem tractable by the same techniques as in the two-dimensional case, in particular by expansion of the solution by means of a Fourier-Bessel series, in appropriately chosen coordinates. Results are presented for specific classes of freestream disturbances, and the study shows conclusively that the shock is stable to all classes of disturbances (i.e. time periodic perturbations to the shock do not grow downstream), provided the flow downstream of the shock is supersonic (loosely corresponding to the weak shock solution). This is shown from our numerical results and also by asymptotic analysis of the Fourier-Bessel series, valid far downstream of the shock.

Author

Supersonic Flow; Uniform Flow; Wedges; Shock Waves; Free Flow; Fourier Series; Aerodynamic Characteristics; Aerodynamic Stability

19970023005 Naval Postgraduate School, Monterey, CA USA

Experimental Investigation of Flow Control by Means of Airfoil Flapping

Yue, Jiannwoei, Naval Postgraduate School, USA; Sep. 1996; 94p; In English; Original contains color plates

Report No.(s): AD-A322347; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Flapping airfoils generate thrust-producing jet-like wakes. It therefore is the objective of this investigation to explore whether this feature can be used for effective flow control. to this end, the flow characteristics of flapping airfoils are first explored in a water tunnel experiment, using dye flow visualization and laser-doppler velocimeter. The effect of airfoil flapping frequency and amplitude of oscillation and of flow velocity on the wake flow characteristics are determined. This is followed by a second water tunnel experiment, where a small flapping airfoil is mounted in and near the separated flow region caused by the flow over a backward-facing step. The effect of airfoil size, location, frequency, and amplitude of oscillation on the separated flow region is again determined by means of laser-doppler velocimeter. It i s found that the reattachment length of the separated flow region can be reduced by as much as 70%.

DTIC

Experimentation; Investigation; Flow Visualization; Airfoils; Flapping

19970023056 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

Three Dimensional Viscous Flow Field in an Axial Flow Turbine Nozzle Passage ***Final Report***

Ristic, D., Pennsylvania State Univ., USA; Lakshminarayana, B., Pennsylvania State Univ., USA; May 1997; 198p; In English

Contract(s)/Grant(s): NAG3-555; RTOP 523-26-33

Report No.(s): NASA-CR-4779; NAS 1.26:4779; E-10772; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The objective of this investigation is experimental and computational study of three dimensional viscous flow field in the nozzle passage of an axial flow turbine stage. The nozzle passage flow field has been measured using a two sensor hot-wire probe at various axial and radial stations. In addition, two component LDV measurements at one axial station (x/c(sum m) = 0.56) were performed to measure the velocity field. Static pressure measurements and flow visualization, using a fluorescent oil technique, were also performed to obtain the location of transition and the endwall limiting streamlines. A three dimensional boundary layer code, with a simple intermittency transition model, was used to predict the viscous layers along the blade and endwall surfaces. The boundary layers on the blade surface were found to be very thin and mostly laminar, except on the suction surface downstream of 70% axial chord. Strong radial pressure gradient, especially close to the suction surface, induces strong cross flow components in the trailing edge regions of the blade. On the end-walls the boundary layers were much thicker, especially near the suction corner of the casing surface, caused by secondary flow. The secondary flow region near the suction-casing surface corner indicates the presence of the passage vortex detached from the blade surface. The corner vortex is found to be very weak. The presence of a closely spaced rotor downstream (20% of the nozzle vane chord) introduces unsteadiness in the blade passage. The measured instantaneous velocity signal was filtered using FFT square window to remove the periodic unsteadiness introduced by the downstream rotor and fans. The filtering decreased the free stream turbulence level from 2.1% to 0.9% but had no influence on the computed turbulence length scale. The computation of the three dimensional boundary layers is found to be accurate on the nozzle

passage blade surfaces, away from the end-walls and the secondary flow region. On the nozzle passage endwall surfaces the presence of strong pressure gradients and secondary flow limit the validity of the boundary layer code.
Author
Axial Flow Turbines; Three Dimensional Flow; Viscous Flow; Nozzle Flow; Aerodynamic Characteristics; Cross Flow

19970023059 NASA Dryden Flight Research Center, Edwards, CA USA
STARS: An Integrated, Multidisciplinary, Finite-Element, Structural, Fluids, Aeroelastic, and Aeroservoelastic Analysis Computer Program
Gupta, K. K., NASA Dryden Flight Research Center, USA; May 1997; 286p; In English
Contract(s)/Grant(s): RTOP 953-36-00
Report No.(s): NASA-TM-4795; NAS 1.15:4795; H-2151; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

A multidisciplinary, finite element-based, highly graphics-oriented, linear and nonlinear analysis capability that includes such disciplines as structures, heat transfer, linear aerodynamics, computational fluid dynamics, and controls engineering has been achieved by integrating several new modules in the original STARS (STructural Analysis RoutineS) computer program. Each individual analysis module is general-purpose in nature and is effectively integrated to yield aeroelastic and aeroservoelastic solutions of complex engineering problems. Examples of advanced NASA Dryden Flight Research Center projects analyzed by the code in recent years include the X-29A, F-18 High Alpha Research Vehicle/Thrust Vectoring Control System, B-52/Pegasus Generic Hypersonics, National AeroSpace Plane (NASP), SR-71/Hypersonic Launch Vehicle, and High Speed Civil Transport (HSCT) projects. Extensive graphics capabilities exist for convenient model development and postprocessing of analysis results. The program is written in modular form in standard FORTRAN language to run on a variety of computers, such as the IBM RISC/6000, SGI, DEC, Cray, and personal computer; associated graphics codes use OpenGL and IBM/graPHIGS language for color depiction. This program is available from COSMIC, the NASA agency for distribution of computer programs.
Author
Aeroservoelasticity; Computational Fluid Dynamics; Computer Programs; Finite Element Method; Graphic Arts; Structural Analysis; Nonlinearity; Heat Transfer; Aerodynamics

19970023091 National Aerospace Lab., Emmeloord, Netherlands
Cadmium Substitution on Aircraft
Vaessen, G., National Aerospace Lab., Netherlands; Andrews, F., Short Bros. and Harland Ltd., UK; Brindle, C., British Aerospace Public Ltd. Co., UK; Hultgren, E., Saab-Space A.B., Sweden; Kock, E., Deutsche Aerospace A.G., Germany; Marchandise, D., Aerospatiale, France; tHart, W., National Aerospace Lab., Netherlands; Smith, C. J. E., Defence Research Agency, UK; Feb. 1997; 6p; In English; Also announced as 19970023078; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

A Garteur (Group for Aeronautical Research and Technology in Europe) collaborative program of research being undertaken to evaluate alternatives to cadmium plating for the corrosion protection of high strength steel aerospace components and fasteners is described. Coatings being investigated include electrodeposited zinc-nickel and zinc cobalt-iron, ion vapor deposited and electrodeposited aluminum, metallic-ceramic deposits containing zinc and aluminum flakes and magnetron sputtered aluminum magnesium coatings. The program is examining both the corrosion resistance of the coatings and their galvanic compatibility with aluminum alloy airframe materials. The effects of coatings on fatigue life and susceptibility to hydrogen embrittlement are being determined. Physical properties including conductivity and lubricity are being studied, microstructure and resistance to aircraft fluids. The program involves research in seven laboratories from the aerospace research institutes and the aircraft industry based in France, Germany, The Netherlands, Sweden and the United Kingdom.
Author
Corrosion Prevention; Protective Coatings; Electrodeposition; Magnetron Sputtering; Microstructure; Corrosion Resistance; Airframe Materials; Aluminum Alloys; Research; Vapor Deposition; High Strength Steels

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970022603 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atmospheric Effects of Subsonic Aircraft: Interim Assessment Report of the Advanced Subsonic Technology Program
Friedl, Randall R., Editor, NASA Washington, USA; May 1997; 168p; In English

Contract(s)/Grant(s): RTOP 538-09-16
Report No.(s): NASA-RP-1400; NAS 1.61:1400; Rept-97B00048; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This first interim assessment of the subsonic assessment (SASS) project attempts to summarize concisely the status of our knowledge concerning the impacts of present and future subsonic aircraft fleets. It also highlights the major areas of scientific uncertainty, through review of existing data bases and model-based sensitivity studies. In view of the need for substantial improvements in both model formulations and experimental databases, this interim assessment cannot provide confident numerical predictions of aviation impacts. However, a number of quantitative estimates are presented, which provide some guidance to policy makers.
Author

Atmospheric Effects; Subsonic Aircraft; Predictions; Estimates; Data Bases; Numerical Analysis

19970023387 Massachusetts Inst. of Tech., Cambridge, MA USA

Assimilation of Altimeter Data into a Quasigeostrophic Model of the Gulf Stream System, Part 2, Assimilation Results

Capotondi, Antonietta, Woods Hole Oceanographic Inst., USA; Holland, William R., National Center for Atmospheric Research, USA; Malanotte-Rizzoli, Paola, Massachusetts Inst. of Tech., USA; Journal of Physical Oceanography: Part 1; Jun. 1995; Volume 25, No. 6, pp. 1153-1173; In English
Contract(s)/Grant(s): JPL-958208; NAGw-2711; W-16-351B
Report No.(s): NASA-CR-204983; NAS 1.26:204983; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

The improvement in the climatological behavior of a numerical model as a consequence of the assimilation of surface data is investigated. The model used for this study is a quasigeostrophic (QG) model of the Gulf Stream region. The data that have been assimilated are maps of sea surface height that have been obtained as the superposition of sea surface height variability deduced from the Geosat altimeter measurements and a mean field constructed from historical hydrographic data. The method used for assimilating the data is the nudging technique. Nudging has been implemented in such a way as to achieve a high degree of convergence of the surface model fields toward the observations. Comparisons of the assimilation results with available in situ observations show a significant improvement in the degree of realism of the climatological model behavior, with respect to the model in which no data are assimilated. The remaining discrepancies in the model mean circulation seem to be mainly associated with deficiencies in the mean component of the surface data that are assimilated. On the other hand, the possibility of building into the model more realistic eddy characteristics through the assimilation of the surface eddy field proves very successful in driving components of the mean model circulation that are in relatively good agreement with the available observations. Comparisons with current meter time series during a time period partially overlapping the Geosat mission show that the model is able to 'correctly' extrapolate the instantaneous surface eddy signals to depths of approximately 1500 m. The correlation coefficient between current meter and model time series varies from values close to 0.7 in the top 1500 m to values as low as 0.1-0.2 in the deep ocean.
Author

Altimeters; Assimilation; Gulf Stream; Mathematical Models; Ocean Surface; Hydrography; Geosat Satellites; Climatology

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19970022803 York Univ., Dept. of Psychology, Ontario Canada

Visual and Auditory Sensitivities and Discriminations ***Final Report, 15 Dec. 1993 - 14 Dec. 1996***

Regan, David, York Univ., Canada; Dec. 14, 1996; 163p; In English
Contract(s)/Grant(s): F49620-94-I-0083; AF Proj. 2313
Report No.(s): AD-A321301; AFOSR-TR-97-0084; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This paper discusses the following topics: (1) The ability to judge time to collision with an approaching object is high in central vision but considerably poorer in peripheral vision. (2) A pilot's time to collision with a simulated approaching helicopter depends on the relative contributions of ownship speed and target speed. (3) Binocular judgements of the direction of motion in depth are similar for motion in the vertical and horizontal meridians. (4) Spatial frequency, temporal frequency, orientation and contrast are processed independently and in parallel. (5) Orientation discrimination for cyclopean form and texture-defined form can be as acute as for luminance-defined form. (6) A letter test for measuring the ability to see and recognize texture-defined form has been made freely available. (7) A physiologically-plausible model of the recognition of texture-defined letters has been developed. (8) The ability to recognize texture-defined, motion-defined and luminance-defined letters can be independently lost in pa-

tients with multiple sclerosis. (9) Magnetic brain recording has been used to identify and locate an audio-visual convergence area in human brairand centres for color-defined, texture-defined, and luminance-defined form. (10) Mathematical methods for obtaining the response of auditory hair cells to complex amplitude modulated tones and the harmonic distortion of a pure tone caused by the hair cell transducer function have been developed.
DTIC
Visual Acuity; Helicopters; Auditory Perception; Aircraft Pilots

19970022871 NTI, Inc., Dayton, OH USA
Assessing the Performance Impact of G-Forces: Design of the Acceleration Performance Assessment Simulation System(A-PASS) ***Final Report, May - Nov. 1995***
ODonnell, Robert D., NTI, Inc., USA; Cardenas, Rebecca, NTI, Inc., USA; Eddy, Douglas, NTI, Inc., USA; Shaw, Robert, FCI Associates, Inc., USA; Dec. 1995; 72p; In English
Contract(s)/Grant(s): F41624-95-C-6005; AF Proj. 3005
Report No.(s): AD-A320232; AL/CF-TR-1996-0093; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A performance assessment system for use on a man-rated centrifuge is discussed. The problem of measuring human performance during high G flight simulation is addressed. This research addressed the fundamental problem of using laboratory data to assess the operational military impact (OMI) of physiological stresses. First, a battery of flight task simulations was conceptualized, based on current performance assessment theory. Second, a procedure was demonstrated for converting laboratory measures from this battery into measures of OMI. Specifically, performance data were entered into high-fidelity computer models of aircraft missions, yielding estimates of the military impact of stressors on human performance (e.g., kill probability, circular error - CEP, survivability, etc.). In the pilot demonstration, the effect of a hypothetical stressor on a pop-up air-to-ground maneuver in the F4E aircraft was evaluated. In the undegraded state, the CEP was 25.0 feet (S.D. 10.8 feet). In the degraded state, the CEP was 50.1 feet (S.D. 21.9 feet). This demonstration proved the feasibility of providing operationally meaningful metrics based on laboratory performance data.
DTIC
Performance Prediction; Centrifuges; High Gravity Environments; Human Performance; Flight Simulation; Flight Crews

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970022642 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
A Case Study in Structural Modeling ***Final Report***
Chastek, Gary, Carnegie-Mellon Univ., USA; Brownsword, Lisa, Carnegie-Mellon Univ., USA; Dec. 1996; 64p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A320528; CMU/SEI-96-TR-035; ESC-TR-96-035; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report is one in a series of Software Engineering Institute (SEI) case studies in software architecture. It describes structural modeling, a technique for creating software architectures based on a small set of design elements called structural types. Structural modeling resulted from the efforts of the Air Force Aeronautical Systems Command (ASC/YW) and has been used by Air Force contractors since the late 1980s to design large-scale, high-fidelity aircrew trainer simulation software. This report examines the changes, resulting from the use of structural modeling, to the trainer's software architecture and to the development methods used.
DTIC
Software Engineering; Computerized Simulation; Flight Simulation; Flight Training; Flight Simulators; Training Devices

19970022984 National Aerospace Lab., Tokyo, Japan
Development of Flight Simulation Program for the HYFLEX Vehicle and Flight Analysis
Suzuki, Hirokazu, National Aerospace Lab., Japan; Matsumoto, Yoshiaki, Mitsubishi Space Software Corp., Japan; Jan. 1997; ISSN 0389-4010; 58p; In Japanese
Report No.(s): NAL-TR-1317; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper describes a flight simulation program, used to analyze the navigation, guidance and control system and for flight analysis of the hypersonic flight experiment vehicle (HYFLEX). Up to this time, the earth had been considered as a sphere at NAL. The flight simulation was carried out using the model at the pre- design phase of the HYFLEX. However, more precise flight analysis had to be carried out to predict the splash down point as we planned to recover the HYFLEX vehicle. In this paper, two coordinate systems were newly introduced to deal with the earth as a ellipsoid of revolution and new equations of motion were derived. Also, the gravity model was changed to the model mentioned in Reference 4. to maintain precision, two state vectors were newly defined. The designed navigation, guidance and control system of the HYFLEX is proved to satisfy the mission requirements through the results of flight analysis. Further, more accurate data of the nominal impact point and dispersion of the impact point are obtained.
Author
Hypersonic Flight; Experiment Design; Flight Simulation; Navigation

19970022997 Georgia Inst. of Tech., School of Aerospce Engineering, Atlanta, GA USA
AASERT: Adaptive Control for Diagnosis of Transient Vortex Interactions ***Final Report, Jan. 1993 - Nov. 1996***
Komerath, Narayanan M., Georgia Inst. of Tech., USA; Magill, John C., Georgia Inst. of Tech., USA; Darden, Leigh-Ann, Georgia Inst. of Tech., USA; Dishman, David, Georgia Inst. of Tech., USA; Peterson, Kevin G., Georgia Inst. of Tech., USA; Ames, Richard, Georgia Inst. of Tech., USA; Jan. 29, 1997; 81p; In English
Contract(s)/Grant(s): F49620-93-I-0342; AF Proj. 2307
Report No.(s): AD-A322308; GITAER-EAD-97-1; AFOSR-TR-97-0136; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Two inventions enabled substantial progress on related problems. The Wind Driven Dynamic Manipulator enables high rate, arbitrary trajectory simulation of aircraft maneuvers in the wind tunnel. Adaptive control has been used to converge accurately to specified pitch histories using this light and flexible robotic device, powered by wind energy. Active stabilization has been used to develop a pitch roll yaw manipulator. Laser sheet imaging during pitch yaw maneuvers of a YF-22 model showed transient vortex interactions even duri ng quasi static motions. Dynamic pitch derivatives were measured using system identification and periodic excitation. Static and transient force measurement are feasible. The Stagnation Point Actuator (SPA) enables suppression and amplification of forebody vortex asymmetry, providing effective roll yaw control at high angle of attack. The SPA produces roll and yaw coefficients similar to those of blowing and strakes, with continuous, high rate control of the asymmetry. Wing rock has been induced and suppressed with high repeatability. Piecewise linear frequency domain transfer functions have been used to model the response of the pressure and the roll moment to SPA deflection. Various time scales are identified.
DTIC
Adaptive Control; Diagnosis; Vortices; Wind Tunnel Tests; Flight Simulation

19970023106 Alabama Univ., Electrical and Computer Engineering Dept., Huntsville, AL USA
OPAD-EDIFIS Real-Time Processing ***Final Report***
Katsinis, Constantine, Alabama Univ., USA; Jun. 1997; 42p; In English
Contract(s)/Grant(s): NAS8-38609
Report No.(s): NASA-CR-205011; NAS 1.26:205011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Optical Plume Anomaly Detection (OPAD) detects engine hardware degradation of flight vehicles through identification and quantification of elemental species found in the plume by analyzing the plume emission spectra in a real-time mode. Real-time performance of OPAD relies on extensive software which must report metal amounts in the plume faster than once every 0.5 sec. OPAD software previously written by NASA scientists performed most necessary functions at speeds which were far below what is needed for real-time operation. The research presented in this report improved the execution speed of the software by optimizing the code without changing the algorithms and converting it into a parallelized form which is executed in a shared-memory multiprocessor system. The resulting code was subjected to extensive timing analysis. The report also provides suggestions for further performance improvement by (1) identifying areas of algorithm optimization, (2) recommending commercially available multiprocessor architectures and operating systems to support real-time execution and (3) presenting an initial study of fault-tolerance requirements.
Author
Optical Measurement; Aircraft Engines; Plumes; Real Time Operation; Computer Programs; Multiprocessing (Computers); Fault Detection

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PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19970022251 NASA Langley Research Center, Hampton, VA USA
A Study of Fundamental Shock Noise Mechanisms
Meadows, Kristine R., NASA Langley Research Center, USA; Apr. 1997; 106p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 505-59-52-03
Report No.(s): NASA-TP-3605; NAS 1.60:3605; L-17530; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This paper investigates two mechanisms fundamental to sound generation in shocked flows: shock motion and shock deformation. Shock motion is modeled numerically by examining the interaction of a sound wave with a shock. This numerical approach is validated by comparison with results obtained by linear theory for a small-disturbance case. Analysis of the perturbation energy with Myers' energy corollary demonstrates that acoustic energy is generated by the interaction of acoustic disturbances with shocks. This analysis suggests that shock motion generates acoustic and entropy disturbance energy. Shock deformation is modeled numerically by examining the interaction of a vortex ring with a shock. These numerical simulations demonstrate the generation of both an acoustic wave and contact surfaces. The acoustic wave spreads cylindrically. The sound intensity is highly directional and the sound pressure increases with increasing shock strength. The numerically determined relationship between the sound pressure and the Mach number is found to be consistent with experimental observations of shock noise. This consistency implies that a dominant physical process in the generation of shock noise is modeled in this study.
Author
Shock Waves; Aerodynamic Noise; Acoustic Emission; Vortex Rings; Noise Generators; Entropy

19970022279 NASA Langley Research Center, Hampton, VA USA
Inlet Shape Effects on the Far-Field Sound of a Model Fan
Clark, L. R., NASA Langley Research Center, USA; Thomas, R. H., Virginia Polytechnic Inst. and State Univ., USA; Dougherty, R. P., Boeing Commercial Airplane Co., USA; Farassat, F., NASA Langley Research Center, USA; Gerhold, C. H., NASA Langley Research Center, USA; 1997; 14p; In English; 3rd; Aeroacoustics, 12-14 May 1997, Atlanta, GA, USA; Sponsored by National Oceanic and Atmospheric Administration, USA
Report No.(s): NASA-TM-112838; NAS 1.15:112838; AIAA Paper 97-1589; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A wind tunnel test was conducted to determine the effects of inlet shape on fan radiated noise. Four inlet geometries, which included a long standard flight type inlet, a short, aggressive flight inlet a scarf inlet, and an elliptical inlet were investigated in the study. The fan model used in the study was a 0.1 scale of the Pratt and Whitney Advanced Ducted Propeller (ADP), an ultra high bypass ratio turbofan engine. Acoustic data are presented for a fan speed of 70% (12,000 rpm) and a tunnel speed of 0.10 Mach number, The fan was configured with a 16-bladed rotor and a 40 stator vane set that were separated by 2.0 chord lengths. The radiated noise was measured with 15 microphones on a boom that traversed the length of the tunnel test section. Data from these microphones are presented in the form of sideline angle directivity plots. Noise associated with the test inlets was also predicted using a ray acoustics code. Inlet shape has been found to have a significant effect on both tone and broadband noise, and the non-axisymmetric inlet shape can be used for a noise reduction method.
Author
Far Fields; Vanes; Turbofan Engines; Shrouded Propellers; Stators; Noise Reduction; Geometrical Acoustics; Fan Blades; Aerodynamic Noise; Acoustic Properties

19970022599 NASA Langley Research Center, Hampton, VA USA
Aeroacoustic Measurements of a Wing-Flap Configuration
Meadows, Kristine R., NASA Langley Research Center, USA; Brooks, Thomas F., NASA Langley Research Center, USA; Humphreys, William M., NASA Langley Research Center, USA; Hunter, William H., NASA Langley Research Center, USA; Gerhold, Carl H., NASA Langley Research Center, USA; May 14, 1997; 22p; In English; 3rd; Aeroacoustics, 12-14 May 1997, Atlanta, GA, USA; Sponsored by National Oceanic and Atmospheric Administration, USA
Report No.(s): NASA-TM-112848; NAS 1.15:112848; AIAA Paper 97-1595; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aeroacoustic measurements are being conducted to investigate the mechanisms of sound generation in high-lift wing configurations, and initial results are presented. The model is approximately 6 percent of a full scale configuration, and consists of a main

element NACA 63(sub 2) - 215 wing section and a 30 percent chord half-span flap. Flow speeds up to Mach 0.17 are tested at Reynolds number up to approximately 1.7 million. Results are presented for a main element at a 16 degree angle of attack, and flap deflection angles of 29 and 39 degrees. The measurement systems developed for this test include two directional arrays used to localize and characterize the noise sources, and an array of unsteady surface pressure transducers used to characterize wave number spectra and correlate with acoustic measurements. Sound source localization maps show that locally dominant noise sources exist on the flap-side edge. The spectral distribution of the noise sources along the flap-side edge shows a decrease in frequency of the locally dominant noise source with increasing distance downstream of the flap leading edge. Spectra are presented which show general spectral characteristics of Strouhal dependent flow-surface interaction noise. However, the appearance of multiple broadband tonal features at high frequency indicates the presence of aeroacoustic phenomenon following different scaling characteristics. The scaling of the high frequency aeroacoustic phenomenon is found to be different for the two flap deflection angles tested. Unsteady surface pressure measurements in the vicinity of the flap edge show high coherence levels between adjacent sensors on the flap-side edge and on the flap edge upper surface in a region which corresponds closely to where the flap-side edge vortex begins to spill over to the flap upper surface. The frequency ranges where these high levels of coherence occur on the flap surface are consistent with the frequency ranges in which dominant features appear in far field acoustic spectra. The consistency of strongly correlated unsteady surface pressures and far field pressure fluctuations suggests the importance of regions on the flap edge in generating sound.
Author
Acoustic Measurement; Aeroacoustics; Wing Flaps; Aerodynamic Noise; Body-Wing and Tail Configurations

19970023001 NASA Langley Research Center, Hampton, VA USA
The Effects of Linear Microphone Array Changes on Computed Sound Exposure Level Footprints
Mueller, Arnold W., NASA Langley Research Center, USA; Wilson, Mark R., Lockheed Martin Corp., USA; 1997; 18p; In English; Noise and Vibration Conference and Exposition, 20-22 May 1997, Traverse City, MI, USA; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): NASA-TM-112836; NAS 1.15:112836; Rept-97NV142; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airport land planning commissions often are faced with determining how much area around an airport is affected by the sound exposure levels (SELS) associated with helicopter operations. This paper presents a study of the effects changing the size and composition of a microphone array has on the computed SEL contour (ground footprint) areas used by such commissions. Descent flight acoustic data measured by a fifteen microphone array were reprocessed for five different combinations of microphones within this array. This resulted in data for six different arrays for which SEL contours were computed. The fifteen microphone array was defined as the 'baseline' array since it contained the greatest amount of data. The computations used a newly developed technique, the Acoustic Re-propagation Technique (ART), which uses parts of the NASA noise prediction program ROTONET. After the areas of the SEL contours were calculated the differences between the areas were determined. The area differences for the six arrays are presented that show a five and a three microphone array (with spacing typical of that required by the FAA FAR Part 36 noise certification procedure) compare well with the fifteen microphone array. All data were obtained from a database resulting from a joint project conducted by NASA and U.S. Army researchers at Langley and Ames Research Centers. A brief description of the joint project test design, microphone array set-up, and data reduction methodology associated with the database are discussed.
Author
Airport Planning; Microphones; Noise Prediction (Aircraft); Acoustic Propagation; Linear Arrays; Acoustic Properties; Aircraft Noise; Helicopters; Footprints

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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19970023152 RAND Corp., Santa Monica, CA USA
Acquisition Lessons of the Stealth Fighter
Aug. 1996; 2p; In English
Report No.(s): AD-A322540; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The argument is frequently made that special access or 'black' programs accommodate more efficient and effective ways to buy weapon systems than do conventional acquisition programs. If so, perhaps some of the characteristics of these covert pro-

grams could be transferred to the more conventional procurement programs to enhance their efficiency. That hypothesis is what Project AIR FORCE researchers wanted to test by examining the F-117 Stealth Fighter acquisition program. They concluded that, although it was unlikely that the special set of circumstances surrounding the F-117 procurement could be fully replicated for many other programs, two elements of F-117 program management not only could be but also should be applied more broadly: greater delegation of authority to the program office and requiring only a very few performance requirements by contract.
DTIC
Jet Aircraft; Procurement; Weapon Systems

19
GENERAL

19970022823 Nippon Bunri Univ., Japan
Bulletin of Nippon Bunri University, Volume 21
Bulletin of Nippon Bunri University; Oct. 1993; ISSN 0287-3036; 76p; In Japanese; Also announced as 19970022824 through 19970022825; No Copyright; Avail: Issuing Activity (Nippon Bunri Univ., Japan), Hardcopy, Microfiche

Topics covered include: Initiation and propagation of surface cracks in 2017-T4 aircraft structural aluminum alloy, and parametric test of goodness of fit of Laplace distribution.
CASI
Aircraft Structures; Aluminum Alloys; Crack Propagation; Crack Initiation; Surface Cracks; Microcracks

Subject Term Index

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